

# STATOR COIL FOR A RADIATOR FAN

## BACKGROUND OF THE INVENTION

### 1. Field of the Invention

The present invention relates to an improved stator coil of a brushless direct current micromotor for a radiator, the stator coil particularly having at least two enamel wires co-axially wound together to reduce the time of a winding process in production and minimize the required quantity of stock of finished products.

### 2. Description of Related Art

Radiators with brushless direct current micromotors have many applications in industry. A tendency of these applications is the continuous pursuit of reduction in their sizes. For example, as for notebook personal computers from laptops to palmtops, minimization of their size is still a major object for manufacturers to pursue. Therefore, sizes of micro radiators for the notebook personal computers also should be reduced accordingly.

A conventional radiator normally has a stator coil with a double-coil winding provided therein. In order to minimize the size of the stator coil, the double-coil winding is replaced by a uni-coil winding, which has two opposite terminal ends thereof electrically connected with an alternating-current circuit. When an alternating current runs through the stator coil, an alternating magnetic field is produced by the stator coil to drive a rotor to run. The alternating-current circuit is made in an integrated circuit die so that the size of the stator is minimized.

However, the conventional stator coil with the uni-coil winding still has following disadvantages:

1. the uni-coil winding is wound by using only one enamel wire, but a double-coil winding is wound by using two enamel wires co-axially, so that winding time cost of a uni-

1 coil winding is more than the cost of a double-coil winding, therefore the production  
2 efficiency of the uni-coil winding is low, and the production cost of the uni-coil winding is  
3 high; and

4 2. manufacturers still have to keep double-coil windings in the inventory in addition to  
5 the uni-coil windings, so the stock level is unnecessarily high.

6 Therefore, it is an objective of the invention to provide an improved stator coil for a  
7 radiator fan to mitigate and/or obviate the aforementioned problems.

## 8 SUMMARY OF THE INVENTION

9 A main object of the present invention is to provide a stator coil of a brushless direct  
10 current micromotor for a radiator, the stator coil having at least two enamel wires co-axially  
11 wound together, and each enamel wire having first and second ends respectively extended out  
12 from the stator coil. The first and second ends of the at least two enamel wires of the stator  
13 coil are optionally connected in different ways, so that the stator is optionally formed as a  
14 uni-coil winding in series connection, a uni-coil winding in parallel connection, or a  
15 multiple-coil winding to respectively satisfy different requirements of the micromotors of the  
16 radiators. Time spent to wind the stator coil with multiple enamel wires wound co-axially  
17 together is low.

18 Another object of the invention is to provide a stator coil of a brushless direct current  
19 micromotor for a radiator, as the stator coil can be optionally connected to form a uni-coil  
20 winding, or a double-coil winding, whereby only one type of the stator coil is needed to be  
21 kept in inventory to meet all requirements, so that the stock level is low.

22 A further object of the invention is to provide a stator coil of a brushless direct current  
23 micromotor for a radiator, wherein the stator coil is connected with a drive IC for providing  
24 an alternating-current circuit to the stator coil, so that the size of the stator coil for the radiator

1 is minimized.

2 Other objects, advantages and novel features of the invention will become more apparent  
3 from the following detailed description when taken in conjunction with the accompanying  
4 drawings.

#### 5 BRIEF DESCRIPTION OF THE DRAWINGS

6 Fig. 1 is a perspective view of a stator coil in accordance with the invention;

7 Fig. 2 is a scheme of an equivalent electrical circuit of the stator coil in accordance with  
8 the invention;

9 Fig. 3 is a scheme of an equivalent electrical circuit of a first connection embodiment of  
10 the stator coil in accordance with the invention, showing two enamel wires being connected  
11 to form a series uni-coil winding;

12 Fig. 4 is a scheme of an equivalent electrical circuit of a second connection embodiment  
13 of the stator coil in accordance with the invention, showing two enamel wires being  
14 connected to form a parallel uni-coil winding;

15 Fig. 5 is a scheme of an equivalent electrical circuit of a third connection embodiment of  
16 the stator in accordance with the invention, showing two enamel wires being connected to  
17 form a double-coil winding;

18 Fig. 6 is a scheme of an electrical circuit of the stator connected with a drive IC; and

19 Fig. 7 is a scheme of an electrical circuit of and a true value table of the drive IC.

#### 20 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

21 The present invention relates to a stator coil of a brushless direct current micromotor for  
22 a radiator, the stator particularly including at least two enamel wires co-axially wound  
23 together. As shown in Fig.1, an embodiment of the stator the invention has first and second  
24 enamel wires (10, 20) wound co-axially to form a stator coil (100). The first enamel wire (10)

1 has first and second ends (11, 12) respectively extended out from the stator coil (100). The  
2 second enamel wire (20) also has first and second ends (21, 22) respectively extended out  
3 from the stator coil (100). The stator coil (100) has an equivalent circuit as shown in Fig.2.  
4 The stator coil (100) is connected with a drive circuit in different connection ways in  
5 accordance with different requirements of the radiators.

6 In a first embodiment as shown in Fig.3, the first end (11) of the first enamel wire (10)  
7 and the first end (21) of the second enamel wire (20) of the stator coil (100) act as two  
8 terminal ends. The second end (12) of the first enamel wire (10) is connected with the second  
9 end (22) of the second enamel wire (20), so that the first enamel wire (10) and the second  
10 enamel wire (20) are connected in a series connection, and the stator coil (100) is equal to a  
11 uni-coil winding.

12 When the first end (11) of the first enamel wire (10) and the first end (21) of the second  
13 enamel wire (20) act as two terminal ends, and the first enamel wire (10) is connected with  
14 the second enamel wire (20), the first and second enamel wires (10, 20) are connected in a  
15 parallel connection as shown in Fig. 4. The stator coil (100) is also equal to a uni-coil winding  
16 which is adapted to work under a large outgoing current, and to produce a high operating  
17 speed of the micromotor.

18 Referring to Fig. 5, if the second ends (12, 22) of the first and second enamel wires (10,  
19 20) are connected together to be a first terminal end (13), the first and second enamel wires  
20 (10, 20) between the first ends (11, 21) and the first terminal end (13) respectively act as two  
21 independent windings, and the stator coil (100) is equal to a double-coil winding.

22 It can be appreciated that the opposite first and second ends of the at least two enamel  
23 wires of the stator coil (100) can be optionally connected in different connection ways, so that  
24 the stator (100) is optionally formed as a uni-coil winding in series connection, a uni-coil

1 winding in parallel connection or a double-coil winding to respectively satisfy different  
2 requirements of the radiators. The time spent to wind the stator coil with the multiple enamel  
3 wires is low, and the required stock of the stator coil is also low because there is only one type  
4 of the stator coil kept in the inventory.

5 With reference to Fig. 6, the stator coil (100) with the first and second enamel wires (10,  
6 20) connected in the series connection has the terminal ends (11, 21) thereof respectively  
7 connected with two output ends O1 and O2 of a drive IC (30). An input end Hin of the drive  
8 IC (30) is connected with a Hall IC (40), which is intended to monitor magnetic variation of  
9 the stator coil (100). In the embodiment of the invention, the drive IC (30) is a bridge driver  
10 TA7291P/S made by TOSHIBA. From a scheme and a true value table of the TA7291P/S of  
11 the driver IC (30) shown in Fig.7, it can be understood that the output ends O1 and O2 of the  
12 drive IC (30) alternatively output high voltage. When a direct current is input to the drive IC  
13 (30), an alternating high voltage is output to the terminal ends (11, 21) of the stator coil (100)  
14 via the output ends O1 and O2. As an alternating current is running in the stator coil (100), a  
15 rotor of the motor is driven to run by an alternating magnetic field produced by the stator coil  
16 (100).

17 From the above description, it is noted that the invention has the following advantages:

- 18 1. as the stator coil includes at least two enamel wires wound co-axially together, the  
19 time spent to wind the stator coil is low;  
20 2. the required stock of the stator coil is also low because there is only one type of the  
21 stator coil kept in inventory; and  
22 3. the size of the stator coil of the micromotor for the radiator is minimized.

23 It is to be understood, however, that even though numerous characteristics and  
24 advantages of the present invention have been set forth in the foregoing description, together

1 with details of the structure and function of the invention, the disclosure is illustrative only,  
2 and changes may be made in detail, especially in matters of shape, size, and arrangement of  
3 parts within the principles of the invention to the full extent indicated by the broad general  
4 meaning of the terms in which the appended claims are expressed.